

Remarks

Claims 1-3, 5-11, 13-28 and 32-41 are pending in this application.

A request for continued examination under 37 C.F.R. 114 is submitted with this response.

Claims 22-28, 32-35, 38, and 40-41 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Szeliski et al. (US Patent Number 6,157,747, herein referred to as Szeliski) in view of Seago (US Patent Number 5,990,900). Claims 11, 13-21, 23, and 36-37 stand rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Szeliski and Seago, and in further view of Blank (US Patent Number 5,469,536). Claims 1-3, 5-6, 8-10 and 39 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Szeliski in view of Luken (US Patent Number 5,923,334), and in further view of Seago. Claim 7 stands rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Szeliski, Luken, and Seago, and in further view of Blank.

Claim Rejections – 35 U.S.C § 103(a)

Claims 22-28, 32-35, 38, and 40-41 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Szeliski et al. (US Patent Number 6,157,747, herein referred to as “Szeliski”) in view of Seago (US Patent Number 5,990,900, herein referred to as “Seago”).

The rejection of Claims 22-28, 32-35, 38, and 40-41 for obviousness over Szeliski in view of Seago must fail because neither Szeliski nor Seago teaches creating a geometric model of an object within an image panorama including identifying at least one boundary of the object where the object occupies a field

of view in the panorama of greater than 180 degrees, as required by each of Claims 22-28, 32-35, 38, and 40-41. Details follow.

Claim 22 requires in pertinent part:

“(a)... receiving instructions from a user identifying a three-dimensional geometric surface within an image panorama, the image panorama containing an object having one or more textures, **the object occupying a field of view of more than 180 degrees in the panorama;**

...

(b) using the computer creating a geometric model of the image panorama based at least in part on the three-dimensional geometric surface and the directional vector, wherein creating a geometric model includes identifying at least one boundary of the object and using the identified boundary to associate geometry information with the object, the geometry information comprising 3-D coordinates describing the position and orientation of the object boundary in a reference coordinate system;...(annotations added).

Likewise, independent Claims 32 and 38 include similar limitations to the cited limitations of Claim 22.

The subject office action admits that:

“Szeliski does not expressly suggest:

- Creating a geometric model includes identifying at least one boundary of the object and
- Using the identified boundary to associate geometry information with the object,
- oThe geometry information comprising 3-D coordinates describing the position and orientation of the object boundary in a reference coordinate system.” (See, Office Action, page 9-10.)

Thus, if the combination of Szeliski and Seago teaches limitation (b) of Claim 22, Seago '900 must supply the teaching of modeling the object using an identified boundary of the object where the object occupies a field of view of more than 180 degrees in the panorama as required by limitation (a) of Claim 22. However, **Seago's method fails when the object to be modeled occupies a field of view greater than 180 degrees in the input image(s).** Details follow.

The input to Seago's method is a 2-D perspective image or a group of 2-D images displaying the object to be modeled. (See, e.g., Seago, col. 11, lines 45-47). However:

- (1) Because the object requires a field of view of more than 180 degrees, the object will not fit on a single 2D perspective image. Each 2D perspective image in the set of images can show only a portion of the object.
- (2) Seago's method for modeling objects from multiple 2D perspective images **requires** that each 2D perspective image show enough matching conjugate features to uniquely determine the relative orientation of the 2D perspective images. If the images do not contain the required conjugate vertices, lines or planes, Seago's method fails. (See, Seago '900, col. 7, lines 29-41.)
- (3) Unless the entire object to be modeled fits on each 2D perspective image in the set of images, the required matching features among the images will be absent.

Thus, Seago '900's method of 3D modeling will fail for any object that covers a field of view greater than 180 degrees in the input panorama and the combination of Seago '900 with Szeliski '747 will not satisfy the limitations of Claim 22 of the subject application.

Statements 1-3 concerning Seago's method are illustrated in figs. 1-10, which are shown below.

1. Because the object requires a field of view of more than 180 degrees, the object will not fit on a single 2D perspective image. Each 2D image in the set of images will show only a portion of the object.

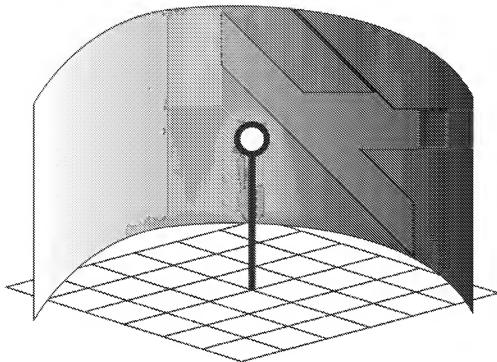


Fig. 1

The curved wall is an object that extends beyond 180 degrees in the input panoramic image. The lollipop represents the camera position; the wall object surrounds the camera position.

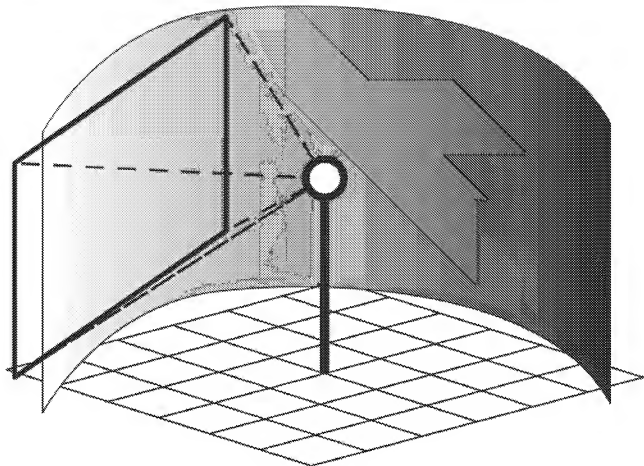


Fig. 2.

The camera acquires 2D perspective images. To create a mosaic similar to Szeliski, the user must take multiple overlapping photos to span the wall's extent, which is > 180 degrees.

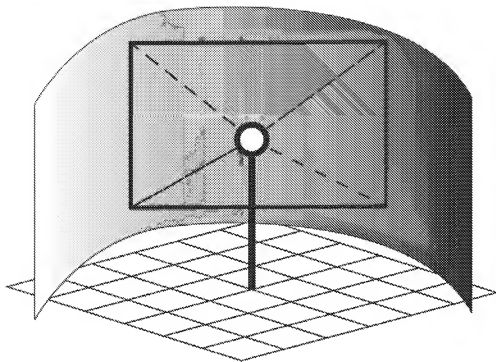


Fig. 3.

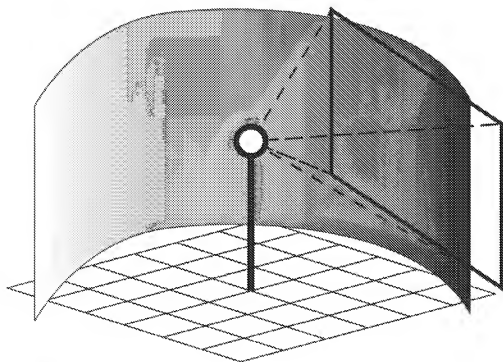


Fig. 4.

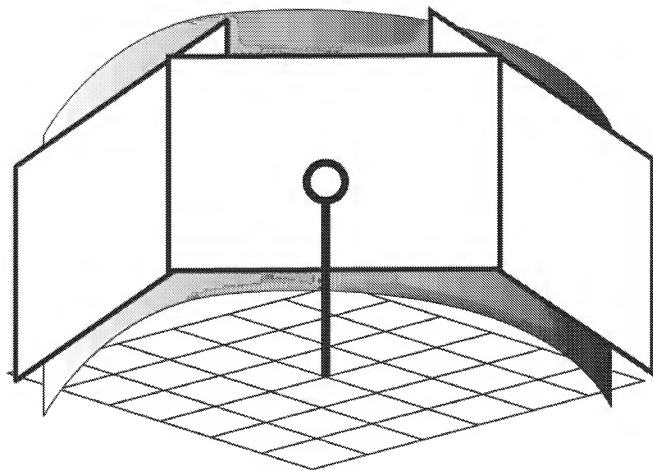


Fig. 5.

Without loss of generality, the mosaiced image to be used comprises three 2D images that have sufficient overlap to register the images.

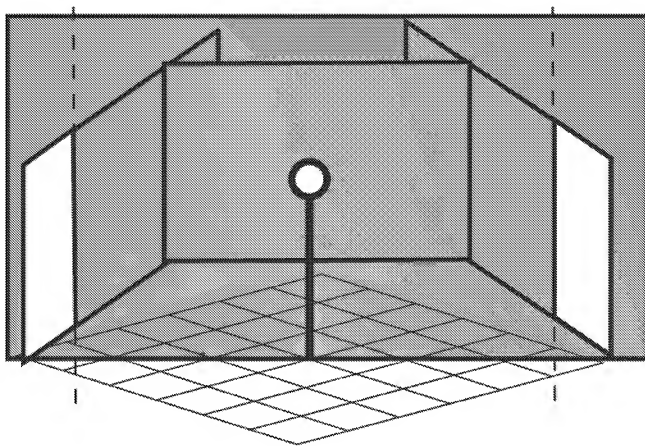


Fig. 6.

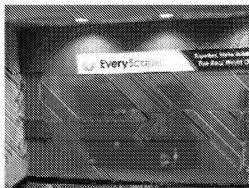
But the final mosaic created with the three initial images cannot be displayed as a single 2D perspective image that preserves the features that are used to register or model the scene. As shown above, using Szeliski's method, the image pose cannot change without distorting the original images or cropping features not visible within the 180 degree limit for the 2D perspective image required as input for Seago's method. The white portions of the images of the wall object illustrate that at least a portion of the wall object will be left out of any single 2D perspective image. After all, the wall object spans a field of view with more than 180 degrees.

2. Seago's method for modeling objects from multiple 2D perspective images **requires** that each 2D perspective image show enough matching conjugate features to uniquely determine the relative orientation of the 2D perspective images. If the images do not contain the required conjugate vertices, lines or planes, **Seago's method fails**. (See, Seago '900, col. 7, lines 29-41.)

This statement follows directly from Seago 900's disclosure.

3. Unless the entire object to be modeled fits on each 2D perspective image in the set of images, the required conjugate matching features among the images will be absent.

Taking the simplest example of a plane, consider the process of geometrically modeling the wall, which is taken as two overlapping images, A and B.



A



B

Fig. 7.

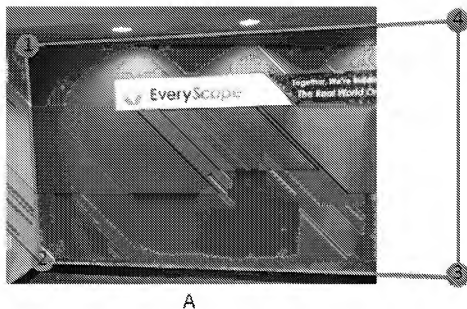


Fig. 8.

To model a plane, four points or edges need to be corresponded between images A and B. However, because image A contains only a portion of the wall, points 3 and 4 that describes the wall's rightward extent must be selected arbitrarily and will be unusable for modeling the wall object accurately.

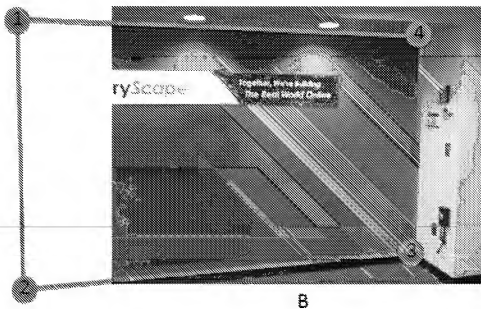


Fig. 9.

Likewise, in image B, vertices 3 and 4 can be identified with certainty, but vertices 1 and 2 are arbitrary and, therefore, are unusable for modeling the wall with certainty.

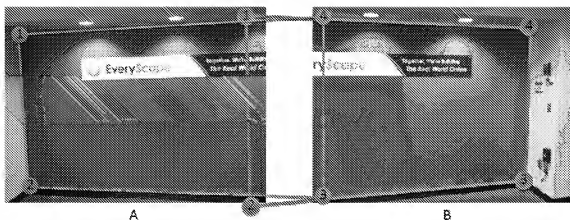


Fig. 10.

Fig. 10 illustrates the impossibility of identifying sufficient, correct conjugate points to apply Seago's method when the entire object cannot fit onto a single 2D perspective image. Forming correspondences between image point A-1/image point B-1 and image point A-2/image point B-2 does not work because image point B-1 and image point B-2 are arbitrary. Likewise, forming correspondences between image point A-3/image point B-3 and image point A-4/image point B-4 does not work because image point A-3 and image point A-4 are arbitrary. Because correct conjugate matches cannot be determined when the entire object does not fit on each 2D perspective input image, then the simplest case of a wall cannot be modeled using the method disclosed in Seago '900.

Szeliski '774's method can be used to produce a single 2D image that has four vertices visible to model in the case of the wall shown in figs. 7-10, since the wall's extent is not great than 180 degrees. But for objects that require

more than a 180 degree field of view, the necessary vertices cannot be projected onto a single 2D perspective image to satisfy Seago '900's method. (See figs. 1-6 and accompanying discussion above.) If a mosaic/panorama with an object extends beyond 180 degrees, the image needs to be warped/remapped to fit into a single 2D image. Warping or remapping features does not work for Seago's method because Seago's method relies on perspective.

Because step "b" of Claims 22, 32 and 38, for objects that occupy a field of view greater than 180 degrees as required by step "a," is neither taught nor suggested by any combination of the teachings of Szeliski and Seago, a prima facie case of obviousness is lacking. Claims 22, 32 and 38 are therefore deemed patentable. Claims 23-28, 33-35 and 40-41 depend from Claims 22, 32, and 38, respectively and add further limitations. Each of these claims is deemed nonobvious over Szeliski in view of Seago for at least the same reasons as for Claims 22, 32 and 38.

Claims 11, 13-21, 23, and 36-37 stand rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Szeliski and Seago, and in further view of Blank (US Patent Number 5,469,536).

The rejections of Claims 11, 13-21, 23, and 36-37 for obviousness rely on Szeliski and Seago for teaching the limitations cited above for Claim 22 and 32, namely: limitation (b) of Claim 22, where the object occupies a field of view of more than 180 degrees in the panorama as required by limitation (a) of Claim 22. Therefore, a prima facie case of obviousness is lacking for each of these claims because, as shown above, Szeliski and Seago do not teach, disclose or

suggest these limitations of the claims. Claims 11, 13-21, 23, and 36-37 are therefore deemed patentable over the cited references.

Claims 1-3, 5-6, 8-10 and 39 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Szeliski in view of Luken (US Patent Number 5,923,334), and in further view of Seago.

The rejections of Claims 1-3, 5-6, 8-10 and 39 for obviousness rely on Szeliski and Seago for teaching the limitations cited above in rejecting Claim 22 and 32, namely: limitation (b) of Claim 22, where the object occupies a field of view of more than 180 degrees in the panorama as required by limitation (a) of Claim 22. Therefore, a prima facie case of obviousness is lacking for each of these claims because, as shown above, Szeliski and Seago do not teach, disclose or suggest these limitations of the claims. Claims 1-3, 5-6, 8-10 and 39 are therefore deemed patentable over the cited references.

Claim 7 stands rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Szeliski, Luken, and Seago, and in further view of Blank.

The rejection of Claim 7 for obviousness relies on Szeliski and Seago for teaching the limitations cited above in rejecting Claim 22 and 32, namely: limitation (b) of Claim 22, where the object occupies a field of view of more than 180 degrees in the panorama as required by limitation (a) of Claim 22. Therefore, a prima facie case of obviousness is lacking for Claim 7 because, as shown above, Szeliski and Seago do not teach, disclose or suggest these

limitations of the claims. Claim 7 is therefore deemed patentable over the cited references.

Applicant requests reconsideration of all pending claims and a notice of allowance. The Examiner is requested to telephone the undersigned if any matters remain outstanding so that they may be resolved expeditiously. The Commissioner is hereby authorized to charge any deficiency in the fees filed, asserted to be filed or which should have been filed herewith to our Deposit Account No. 19-4972.

Respectfully submitted,

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